2.4 Total Nitrogen Loading

TN loadings have also likely been affected by agricultural and urban development within the study area as changes in land use have led to increased nitrogen loading to the estuary. This increased nitrogen loading to the estuary, in combination with the increased phosphorus loading described above, results in eutrophication within the estuary. The rainfall and GIS land cover model discussed previously was used to estimate relative TN loading rates for the basins.

Monthly-specific TN loading estimates were determined for each individual parcel of urban and agricultural land within a tertiary basin, using runoff coefficients (Appendix B) specific for south Florida, with variation by land use/cover and hydrologic soil group, and adjusted for wet or dry season conditions. Loading estimates for each individual parcel within a tertiary basin were summed to compute the TN loading for that basin and month, using the following equation:

$$TNL_{j,t} = \hat{q}_{j,t}\ N_l$$

where: $TNL_{j,t}$ = estimated total monthly nitrogen loading in the t^{th} month for the j^{th} tertiary basin,

$\hat{q}_{j,t}$ = estimated total monthly runoff discharge in the t^{th} month for the j^{th} tertiary basin, as described previously, and

N_l = TN concentration for land use l.

Following the methodology used for the previously discussed criteria, the tertiary basins were assigned relative ranks according to estimated total annual nitrogen loading. This analysis resulted in the priority basins presented in Table 2-7; Table 2-8 presents the area-weighted relative ranks for TN loading. Figure 2-7 presents the results of the TN loading ranking of the 62 tertiary basins in the study area grouped as described previously into high, medium, and low impact basins. Figure 2-8 presents the area-weighted results of the TN loading ranking of the 62 tertiary basins in the study area.

Table 2-7. Relative ranks of the top 25% of the tertiary basins within the Estero Bay Watershed for total annual nitrogen loading.

Secondary Basin	Tertiary Basin	Area (acres)	% Urban Land Use	% Agricultural Land Use	Total Nitrogen Load (lbs/yr)	Rank
Imperial River	6	41568	3	25	264673.6	1
Estero River	8	27647	16	27	212751.4	2
Six-Mile Cypress Slough	4	18354	20	23	150414.3	3
Six-Mile Cypress Slough	1	8345	29	15	74307.98	4
Imperial River	4	4695	30	37	49576.94	5
Mullock Creek	4	3596	81	7	41402.36	6
Estero River	6	7467	15	27	41136.08	7
Imperial River	1	3464	61	0	34656.74	8
Ten-Mile Canal	11	2569	42	12	33512.04	9
Six-Mile Cypress Slough	3	3893	42	13	33023.04	10
Hendry Creek	10	2459	59	0	28864.54	11
Barrier Islands	1	15726	13	0	27885.1	12
Estero River	5	2460	41	17	23539.64	13
Spring Creek	7	2482	36	10	22911.87	14
Estero River	3	2699	14	15	21600.32	15
Imperial River	3	1988	58	7	18818.2	16

The top ranked tertiary basins in the Estero Bay Watershed for total nitrogen loading include three basins located in the eastern portion of the watershed that are larger than 18,000 acres in area, and have more that 20% of their land use in agricultural uses. These basins include TB 6 in the Imperial River Basin, TB 8 in the Estero River Basin, and TB 4 in the Six-Mile Cypress Slough Basin. The priority basins with respect to total nitrogen loading are very similar to those with respect to total suspended solids loading, containing 14 of the same tertiary basins. This is not surprising, given that total nitrogen loading and total suspended solids loading are both functions of freshwater runoff. The differences in priority basins for these two criteria are caused by the variation of land use-specific loading coefficients.

The area-weighted rankings of the tertiary basins within the Estero Bay Watershed show that the top-ranked tertiary basin is TB 11 in the Ten-Mile Canal Basin. Three of the top four high priority tertiary basins are in the Hendry Creek Basin. Fifteen of the sixteen high priority tertiary basins have TN loads greater than 10 lb/yr/acre.

To provide a comparison with the area-weighted TN loadings from the basins in Table 2-8, values from drainage basins within the Charlotte Harbor National Estuary Program (CHNEP) study area may be used. The range of area-weighted TN loading from the major basins in the CHNEP study area was from 2.0 lb/yr/acre (for the Pine Island Sound/Matlacha Pass Basin) to 5.3 lb/yr/acre (for the Caloosahatchee River Basin) (PBS&J and Bender, 1998). The area-weighted TN loading from the entire Estero Bay Watershed is 7.0 lb/yr/acre (Appendix A).

Table 2-8. Relative ranks of the top 25% of the tertiary basins within the Estero Bay Watershed for area-weighted total annual nitrogen loading.

Secondary Basin	Tertiary Basin	Area (acres)	% Urban Land Use	% Agricultural Land Use	Area-weighted Total Nitrogen Load (lbs/yr)/acre	Rank
Ten-Mile Canal	11	2569	42	12	13.0457	1
Hendry Creek	9	517	67	0	12.0308	2
Hendry Creek	10	2459	59	0	11.7398	3
Hendry Creek	8	863	66	7	11.5284	4
Mullock Creek	4	3596	81	7	11.513	5
Spring Creek	6	545	40	0	11.3219	6
Mullock Creek	5	290	53	0	11.0111	7
Ten-Mile Canal	7	404	47	0	10.6779	8
Imperial River	4	4695	30	37	10.5598	9
Six-Mile Cypress Slough	5	653	14	29	10.3357	10
Estero River	2	72	0	0	10.2914	11
Ten-Mile Canal	10	473	26	0	10.2542	12
Ten-Mile Canal	4	153	67	0	10.0608	13
Imperial River	1	3464	61	0	10.0056	14
Hendry Creek	6	449	63	7	10.0011	15
Hendry Creek	5	1874	27	29	9.7186	16

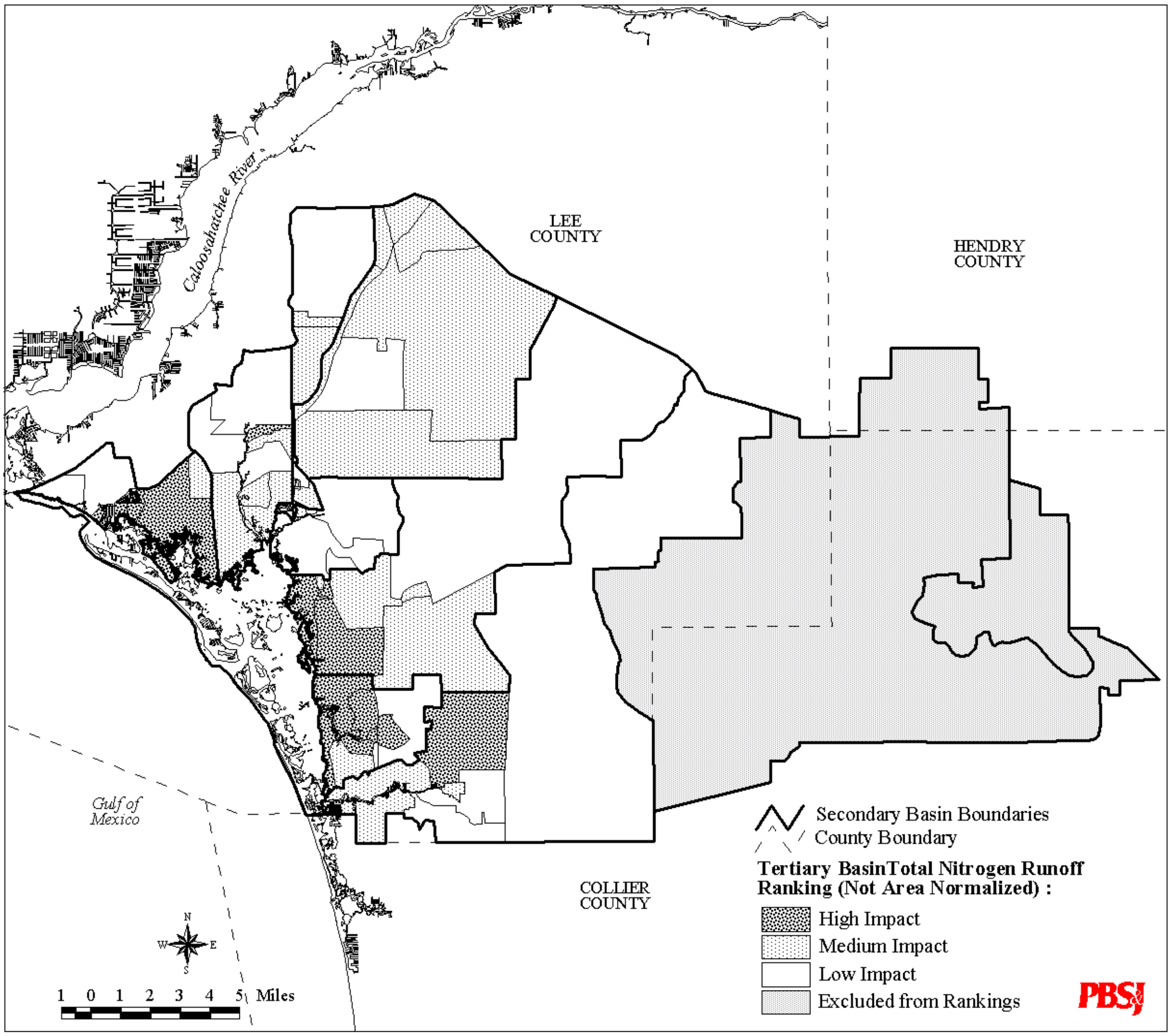

Figure 2-7. Tertiary basins classified by total annual nitrogen loading.

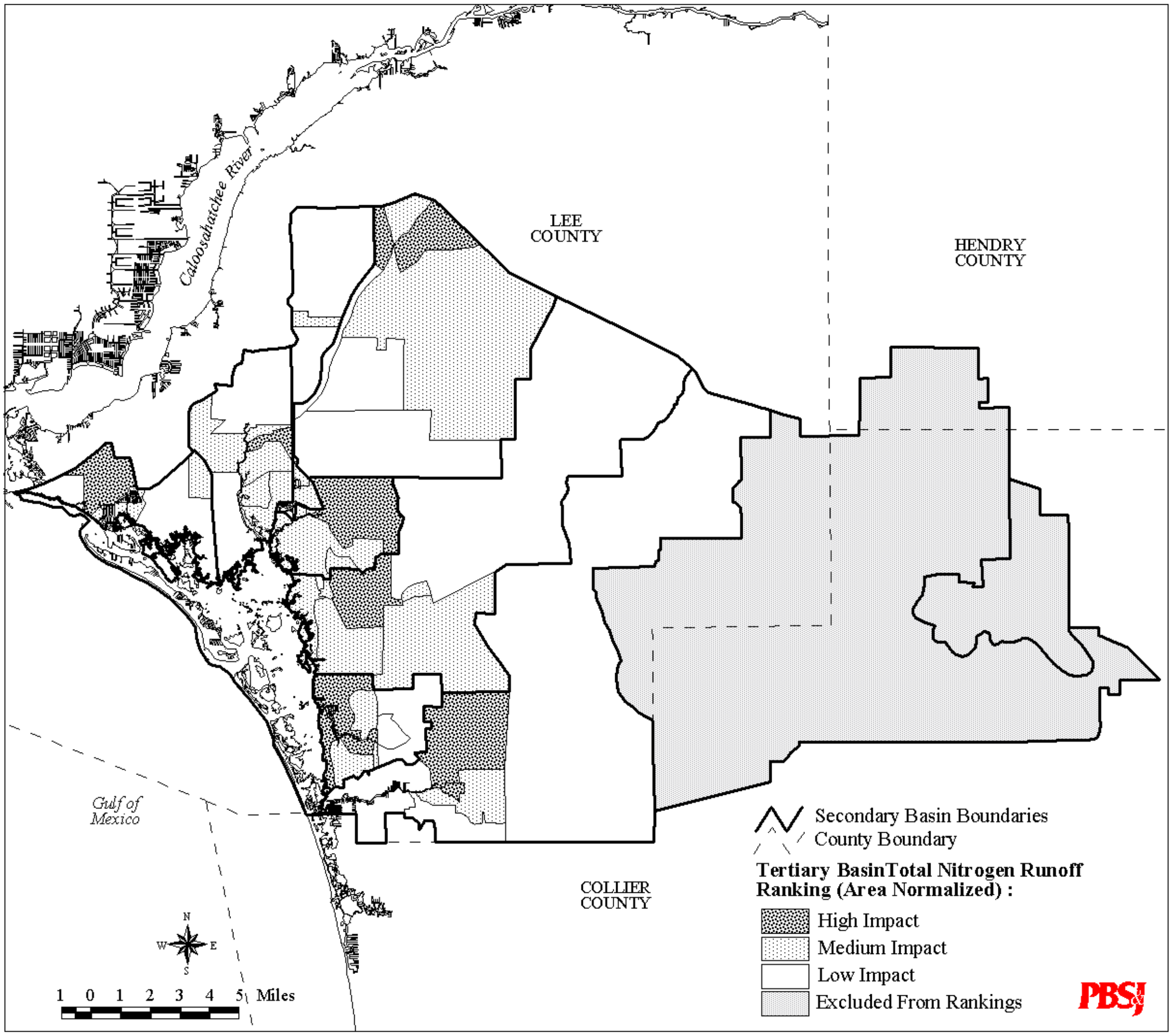

Figure 2-8. Tertiary basins classified by area-weighted total annual nitrogen loading.